By having a PL259 arrangement at ground level it is then a simple matter to move your rig out into the backyard on sunny days. Add a few cold drinks, lemonade of course, thereby, during the JOTA days keeping everybody out of the shack. Well — I thought it was a good idea!

Getting the dipole as high as possible certainly helps, not only from a performance point of view but also keeps it away from surrounding and offending objects. This also assures the length won't have to be altered too much if the antenna is well clear of everything. The ends are particularly sensitive to nearby objects such as trees, guttering and roofing etc. Although the just mentioned reasons will often be the best approach some extra gain might be achieved on transmission by mounting the dipole at some predetermined wavelength multiple from the ground. The ground reflection could then add up to the transmitted signal giving some extra "oomph". Interested readers should refer to the RSGB or ARRL handbooks for information but remember the height will be a compromise with a 2 band design. The only amount of tuning required assuming a good location will be to bring the lowest VSWR point to your favourite portion of the band.

This is fairly straightforward, and my favourite way is to check the VSWR at the extreme ends of each band. It is then a simple matter to see which way, longer or shorter, to adjust the ends. The method I used is seen in Figure 1 but this is optional and you may have a better idea. There will be a slight interaction between the 2 bands during pruning so after one band dipole is adjusted check both bands before doing the other.

Sometimes if things are not going well and a high VSWR, over 1.5 to 1, is experienced try reversing the whole array or adjust the height. There should only have to be a few inches of adjustment to get it spot on.

But don't worry too much if 1.5 to 1 is the lowest VSWR you get as the VSWR does not always tell the whole story. My results are 1.3 to 1 at resonance on 15 metres and 1 to 1 at resonance on 20 metres and the height is about 45 feet off the ground.

Although it's great to have a tower and a Yagi or a Quad, I did have, it still gives me great satisfaction working the world on a simple wire antenna like a dipole and it's also a lot of fun.

ar

A Fault in the PLL of an IC22S

Keith Gooley VK5BGZ
Lot 15 Tenafeate Court
One Tree Hill SA 5114

Do you own an IC22S which is either not working at all or works only intermittently? There must be quite a few of you as there were over 3000 IC22Ss sold in Australia. If you have such a rig, I hope this article will help you to get it working again.

ONE OF THE THINGS I like about the IC22S for mobile operation is that you don't have to look at the rig to change channels, just count the clicks of the switch as you rotate it, and it doesn't have a microprocessor which is prone to lose its memory. These otherwise excellent mobile two metre FM rigs have a reputation for intermittent faults, primarily in the Phase Locked Loop (PLL) board. So it was with my IC22S.

Before going on to describe the faults and the method of repair, it may be helpful to give a description of the basic operation of the IC22S PLL.

Figure 1 is a block diagram of the PLL itself. The voltage controlled oscillator (VCO) is the first local oscillator for the receiver. Its output goes to a mixer as well as the transmitter and receiver. The VCO frequency is translated down from the MHz to kHz region as the frequency dividers are not fast enough to divide down the 135 MHz signal directly. The local oscillator for this mixer is a single overtone crystal on 44.567 MHz and the third harmonic on 133.7 MHz is selected in the collector circuit of the oscillator.

The resulting output signal from the mixer on 50 kHz to 3.6 MHz is divided by 2 in one flip-flop of a 4013 IC. These CMOS devices have a maximum input frequency for a supply voltage of 9 volts of about 10 MHz, and so if the VCO frequency goes above about 144 MHz for any reason, this divider will cease to work and this may prevent the VCO from being pulled back down again.

The 4013 output passes to IC1 the programmable divider which simply divides the input frequency by the number applied in binary format to its programming pins.This can be any number from 2 to 255. At the lower limit of the frequency range, 144.4 MHz this IC divides by 2 and at the top end, 147.975 MHz it divides by 143. These are the transmit frequencies for simplex or +600 kHz and for these two modes, 24 is added to the divisor during receive. The 24 is derived from 600 divided by 25, 25 being the frequency increment of the programmable divider.

For PLL's in general this increment is usually equal to the reference frequency at which the phase comparison is done, but in the IC22S the heterodyned down VCO frequency is divided by 2 before entering the programmable divider and hence the reference frequency is required to be 12.5 kHz to give channel spacings of 25 kHz. When the loop is locked the output of this IC is always 12.5 kHz which is the reference frequency for the PLL. IC3 is a crystal oscillator divider which produces a 25 kHz signal by dividing the 6.4 MHz crystal signal by 256. This 25 kHz is further divided by 2 in the other half of the 4013 flip-flop. This latter stage is not shown on the circuit diagram which came with the set.

The two 12.5 kHz signals, divided down VCO and reference, are phase compared in IC2 which also contains an op-amp forming part of the loop filter. This is a low pass filter to remove any 12.5 kHz components which may modulate the VCO. The DC voltage at the output of this filter is proportional to the phase difference between the two input signals and goes high if the VCO frequency is too low and vice-versa. The amount by which the VCO moves in frequency for each volt change on its control input, known as the VCO constant is about 1.6 MHz per volt. So there is only about 2 volts change in the voltage on pin 1 of IC2 for the full range of the PLL.

The Faults

Now back to the problems with my IC22S. The unit would not lock in at switch-on, or it would lose lock at various times, most embarrassing when in the middle of a QSO. The manual is quite comprehensive in describing the operation of the PLL and I found that with the PLL not locked, the supply voltage to the 4013 dual divide by two flip-flop fell to less than five volts, instead of nine. This was traced to a dry solder joint on the supply side of R25, a 15 Ohm resistor.

Once this was cured the two divide by twos operated properly but the programmable divider IC1 (TC5080P) was not functioning. This is best checked with a CRO but a logic probe or even a simple RF probe and multimeter will tell you if there is a full nine volt swing out of the divider (pin 10). The frequency will be 12.5 kHz when the PLL is locked. I found no signal to speak of at the output and the input waveform did not go down to zero volts. The output of the 4013 which drives the 5080 is connected to it by a wire link on top of the board, making it easy to disconnect and measure the current which flowed to battery negative through the current shunt of the multimeter from the input pin of the 5080. It was several mA, much more than the 4013 could drive and so I assumed that the 5080 was faulty.

Let's have a think. The programmable divider is simply a device which accepts an 8 bit binary word and divides the input frequency by that number; feed it the binary equivalent of 63 and it divides by 63; feed it 187 and the input frequency is divided by 187; quite a common function in the digital world. Looking through the 4000 series CMOS data book, I found a 4526 which is a 4 bit binary programmable divider, capable of being cascaded to produce dividers of any length. Referring to the application circuit in the data sheet, I soon produced the equivalent circuit function to the original TC5080P. See fig 2.

It was then only a matter of connecting the two 4526's up on a piece of veroboard, see fig 2, and attaching the assembly to the outside of the shield around that part of the PLL. See photograph. The faulty 5080 was removed and the 8 bit divider control connected to the two new CMOS IC's with ribbon cable, the other end of the ribbon cable being soldered into the holes previously occupied by pins 1 to 8 of the 5080. The input signal was run from the 4013 and the output back to the hole where pin 10 of the 5080 used to be.

When I switched on, the rig worked "as good as new" with the replacement ICs performing satisfactorily. Before closing the set up, I made sure the PLL would lock over the full frequency range, adjusting the VCO coil slug such that the VCO control voltage was about 5 volts in the centre of the frequency range. This voltage is available on pin 1 of IC2, a TC5081P phase detector and loop filter. With the loop locked, adjustment of the VCO coil slug causes the control voltage to rise or fall cancelling the effect on the VCO frequency of the change in inductance of the VCO coil. You need to be

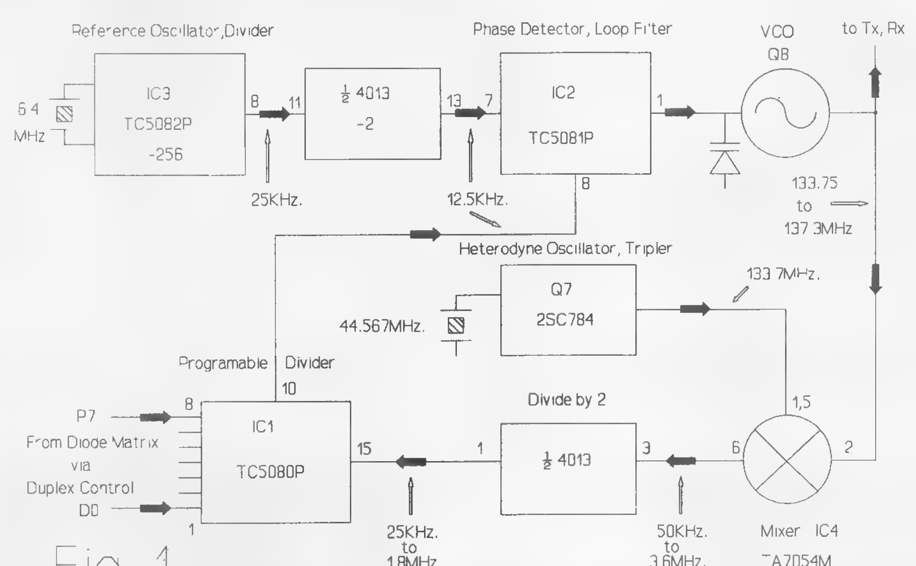

Fig 1

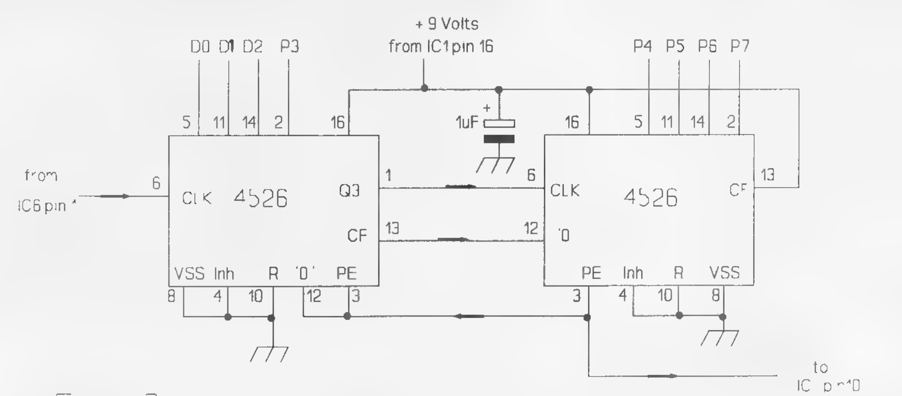

Fig 2

Note;- D0 to P7 come from IC1, pins 1 to 8 respectively careful not to adjust the VCO too low in frequency as it can be moved to the opposite side of the fixed heterodyne frequency (133.7 MHz). Then the loop will never lock as the feedback is positive instead of negative and the VCO will be driven to the lowest frequency and stay there. The correct VCO frequency range is 133.75 to 137.35 MHz.

If your IC22S has a faulty 5080 and you decide to have a go at replacing it with 4526s as I have done, you can test the assembled divider before installing it in the set by checking that it divides by say 104. This is the divisor for a frequency of 147 MHz with the VCO on 136.3 MHz. Connect the 8 data input lines P7 — D0 to the binary equivalent of 104 ie 01101000. Feed an input frequency of 1.30 MHz to pin 6 of the first 4526 and the signal on pin 3 of the second 4526 should be 12.5 kHz. Taking D0 from a 0 to a 1 should reduce the output frequency to 1.3 divided by 105 ie 12.381 kHz. If all is well, the new divider may be installed in the rig with a fair degree of confidence.

I hope this article has helped some of the many IC22S owners to better understand the synthesiser and to get around the high cost of original spare parts.

ar

Try This

Adrian Fell VK2DZF Box 344 Baulkham Hills 2153

RG58U coaxial cable braid, when stripped of the inner cable and insulation, makes a good flexible wire for feed point connections on antennae.

The braid should be run through pinched fingers to flatten it out first.

ar

Technical Abstracts

Gil Sones VK3AUI
30 Moore Street
Box Hill South, 3128

Transceiver PSU from Computer PSU

UDO THEINERT DL2YEO in the April 1992 issue of CQ DL describes the conversion of a computer power supply into a 12-volt high current power supply for a HF transceiver. A translation of the article appears in the Rad Com column Eurotek by Erwin David G4LQ1 in the July 1992 issue.

PCs have a switching power supply which has output capabilities from 60 to 200+ watts. I have seen 350 watt versions and 200 watt units are common. The price is very reasonable with new units retailing in the range of $100 to $200. Even less for flea market and ex-service stock.

Udo DL2YEO came by one, which after investigation and some work, he converted into a power supply for a HF transceiver. He found that the supply used a common regulator IC type TL494. All the outputs came from a common tapped secondary winding via rectifiers and filters. This meant that rewinding the transformer was not needed as the wire could accommodate the highest current supply.

Conversion consisted of rewiring the output from multiple outputs to a single 12 volt output using the high current rectifiers previously used for the 5 volt output. Some rewiring of the filtering was also needed. The voltage regulator reference and protection circuitry needed some adustment to cope with this change. The circuit had circuits to protect from over-current and to provide short circuit protection. There were simply re-instated with modifications for a single output voltage.

Additionally a load bleeder resistor was installed to provide a minimum load and some additional storage capacitors were installed along with additional filter sections. The mains input had an additional block mains filter installed. The DC output needed an additional Pi section added to eliminate noise.

These supplies follow a common general block diagram as shown in Fig 1. The first step in conversion is to obtain a circuit. If the is not available it should not be too hard to trace. Then set it up with loads on all outputs and measure voltages at all points. This will aid in restructuring the voltage regulator reference and protection circuits to single output.

Safety

Remember when working on a switching power supply that part of it is at AC Mains potential. An isolation transformer is handy but you should always switch off and unplug before touching anything. This is particularly important when directly plugged into the AC Mains. PC power supplies use transformer isolation between input and output but there is a signficant amount of curcuitry at mains potential. The regulator and output DC circuits are quite safe as they are isolated by transformers. However, remember that you should treat anything inside the box with respect. Switch off and unplug before touching things.

For additional mains filtering use one of the proprietary block main filters. These are made for the job. Do not make your own.

The Rad Com article carries a translation of the original article and it